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(54) Apparatus for packaging articles

(57) A method and apparatus for the packaging a succession of articles with heat shrinkable material, comprising the steps of feeding the articles along a predetermined feed direction A to a location 2 in which the articles 4 are tubed within the wrapping material with a length 18 of the wrapping material 10 extending between each adjacent pair of articles, the material of said length being intended to complete the wrapping of the adjacent region of the said adjacent pair of articles, subjecting the material to heat shrinking such that the material forming said length 18 is caused to shrink and in so doing produce forces sufficient to rupture said length, and further to cause the servered ends to shrink and tighten against the said adjacent regions of the article pair; and transversely perforating the wrapping material at predetermined locations at which said lengths are to rupture prior to heat-shrinking.

FIG 1

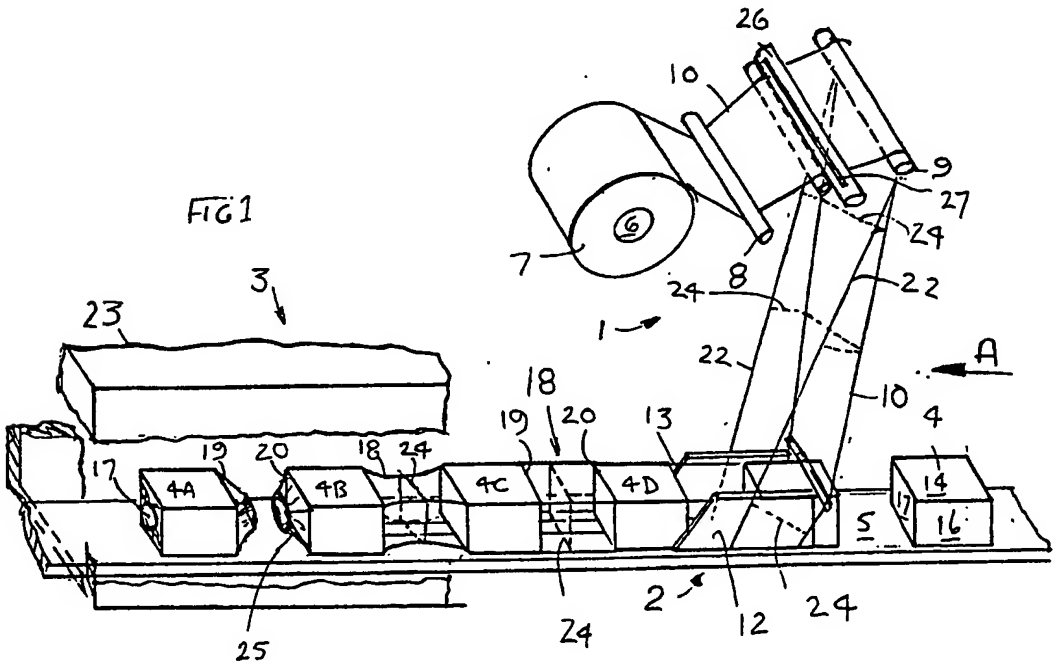

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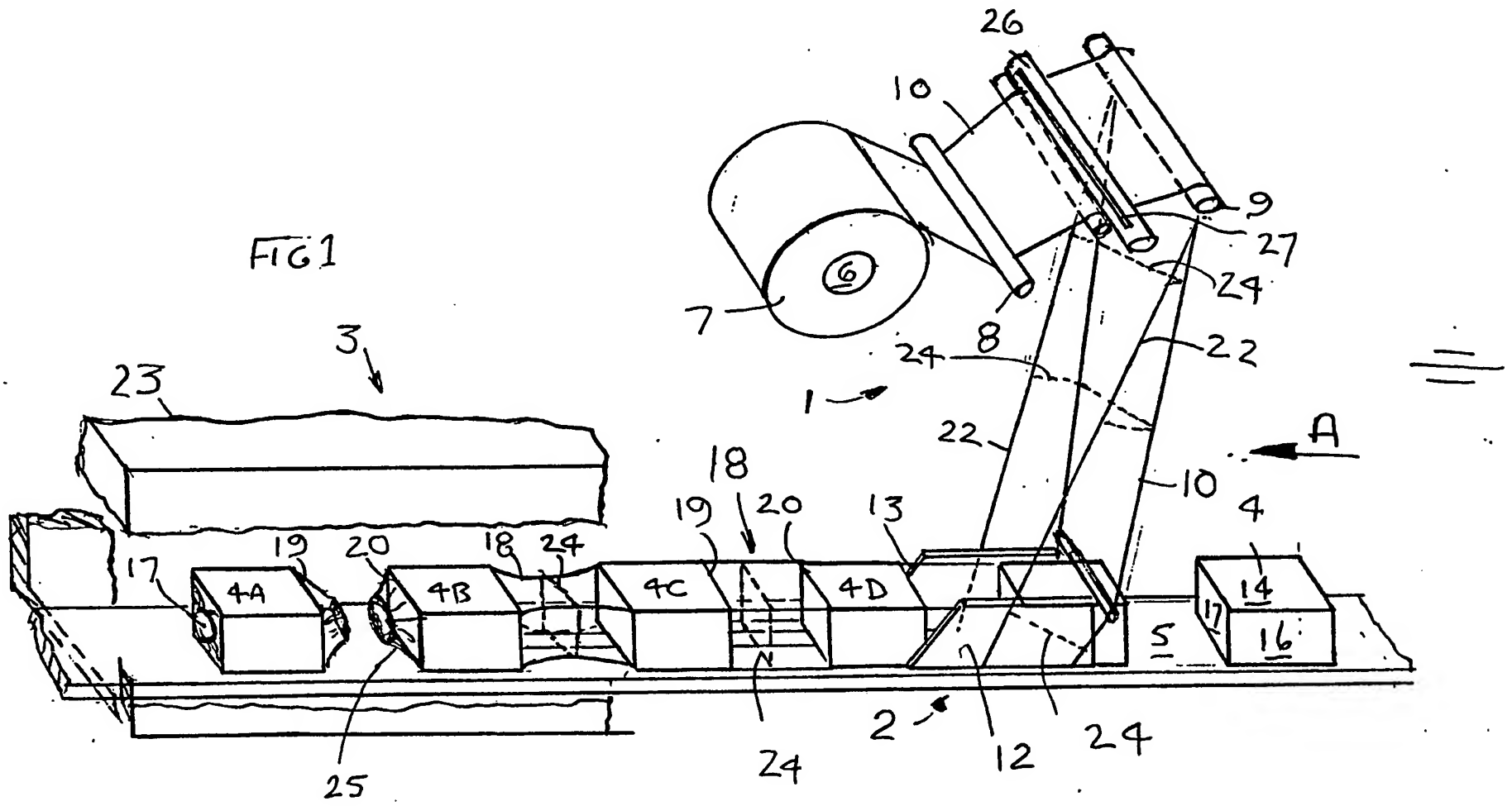
FIG 1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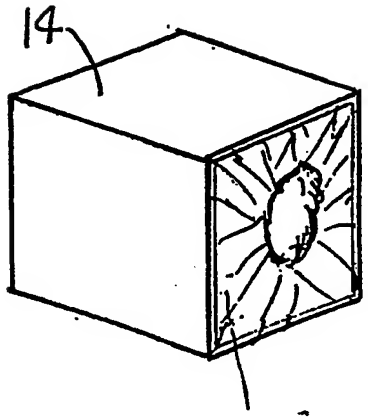

FIG 2

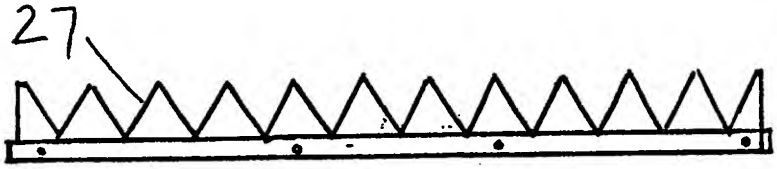

FIG 3

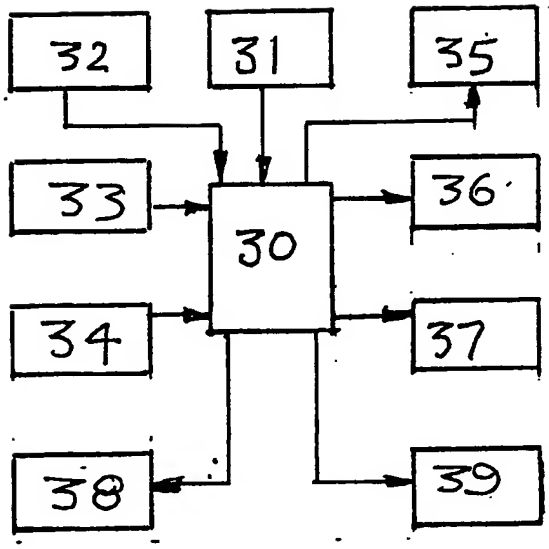

FIG 4

APPARATUS FOR PACKAGING ARTICLES

This invention relates to the packaging of articles, and more particularly to the packaging of articles using heat shrinkable plastics material.

A well known mode of utilising plastics material in sheet form is so to wrap the articles by feeding the sheet material along a predetermined feed direction to a wrapping station, whilst at the same time feeding the articles to be wrapped to the wrapping station in such manner that atthe actual wrapping location the article is moving along said feed direction. At the wrapping station the plastics material that is to wrap the article is, by means of a sheet material guide means, caused to form a tube about the article. In other words the article is effectively wrapped about those surfaces thereof that are extending along said feed direction and at this stage of the procedure effectively leaving the leading and trailing regions (relative to said feed direction) of the article unwrapped.

Following this partial wrapping stage the tube of plastics material containing the partially wrapped article is fed into a plastics material heating tunnel.

The heating arrangements provided within the tunnel are such that during the advance of the plastics material therethrough, the region of the plastics material in the vicinity of the leading and trailing ends of the article is heated sufficiently for the plastics material to contract and shrink sufficiently to draw the plastics material into close contact with the leading and trailing ends of the

article in such manner that these article ends are at least partially wrapped.

Depending upon the length of plastics tube formation provided between said leading and trailing ends these ends are either totally or partially enclosed. If partially closed the heat sealing operation leaves a generally circular region at each end of the article that is unwrapped. With this mode of sealing, the heating of the plastics material at the end regions of the tube formation results in a firm overall wrapping of the article.

When using plastics materials for wrapping in the manner generally discussed above it is frequently required that the packaging should carry printed matter. For example, sales and marketing information.

In such a case it is of great importance that any such printed material should be correctly positioned upon the wrapped article so that undesired offset of printed matter with respect to the wrapped article needs to be avoided.

With the presently known apparatus a number of practical problems have exhibited themselves in relation to; the handling of the plastics sheet material; the capability of being able to wrap articles of varying length particularly along said feed direction; ensuring corrulation between printed matter on the sheet and the desired position thereof on the wrapped article; and to ensuring that the plastics material adjacent a wrapped article breaks readily and accurately positionwise away from the plastics material for wrapping the next following article to be wrapped.

It is an object of the present invention to provide packaging apparatus which at least reduces some of the problems and shortcomings of known apparatus.

Broadly, according to a first aspect of the invention there is provided a method of packaging a succession of articles with heat shrinkable material, comprising the steps of feeding the articles along a predetermined feed direction to a location in which the articles are partially wrapped about surfaces thereof extending along said feed direction and in such manner that a length of the wrapping material is formed between each adjacent pair of articles, the material of said length being intended to complete the wrapping of the adjacent region of the said adjacent pair of articles, subjecting the material to a time/temperature regime such that the material forming said length is caused to shrink and in so doing produce forces sufficient to sever said length, and further to cause the servered ends to shrink and tighten against the said adjacent regions of the article pair; and pre-establishing the position at which said length severs by local physical weakening of the plastics material at predetermined locations prior to the material being subjected to the heating time/temperature regime.

Preferably, local physical weakening is effected by forming lines of easy separation which are conveniently produced by perforating the sheet plastics material along predetermined lines extending transversely of the feed direction thereof from a supply.

According to a second aspect of the invention there is provided apparatus for packaging a succession of articles with heat shrinkable material, comprising means for feeding the articles along a predetermined feed direction to a location in which the articles are partially wrapped about surfaces thereof extending along said feed direction and in such manner that a length of the wrapping material is formed between each adjacent pair of articles, the material

of said length being intended to complete the wrapping of the adjacent region of the said adjacent pair of articles, means for subjecting the material to a time temperature/regime such that the material forming said length is caused to shrink and in so doing produce forces sufficient to sever said length and further to cause the servered ends to shrink and tighten against the said adjacent regions of the article pair; and means for pre-establishing the position at which said length severs by local physical weakening of the plastics material at predetermined locations prior to the material being subjected to the heating time/temperature regime.

For a better understanding of the invention and to show how to carry the same into effect reference will now be made to the accompanying drawings in which :-

Figure 1 is a very schematic representation of a first embodiment of article packaging apparatus involving the concepts of the invention;

Figure 2 is a very schematic cross section of a wrapped package or article, the cross section illustrating the arrangement of the plastics wrapping material on the article; and

Figure 3 illustates a serrated knife for producing perforations in the plastics material; and

Figure 4 is a schematic block diagram representing a control system for the apparatus of Figures 1 to 3.

Referring now to the drawings and more particularly Figures 1 and 2.

The schematically illustrated apparatus for shrink wrapping an article can be conveniently considered as incorporating three main sections; a first including arrangements 1 for feeding in succession articles to be wrapped along a predetermined direction A, a second forming an article wrapping station 2 in which sheet plastics material is being continuously fed from a supply thereof to be automatically partially wrapped around the articles to be wrapped; and thirdly a plastics material heat shrinking unit 3 positioned to receive the partially wrapped articles and to heat seal the plastics wrapping in place.

Articles 4 to be wrapped are fed along the feed direction A to the wrapping station by conveyor arrangements very schematically shown in Figure 1.

The articles can comprise single elements, groups or packages of elements. also the articles can have shapes other than that specifically shown. The conveyor arrangements 5 are arranged to transfer the articles 4 ina succession to and through the partial wrapping station 2 and thence to and through the plastics material heat treatment unit 3. Since the constructional details of the conveyor arrangements do not form part of the present invention they are in consequence not described in detail. It is thought sufficient to note that the conveyor arrangements utilised can incorporate an article in-feed conveyer which serves to feed articles from a supply thereof (not shown) to the article input end of the partial wrapping station 2 and can be of the flat belt type or of the kind incorporating chains provided with article support or engagement means whereby articles can be entrained by the conveyor. Also the conveor arrangements can include a separate conveyor assembly for feeding the partially wrapped articles through the heat shrinking unit.

The partial wrapping station includes a support mandrel 6 for a reel 7 of heat shrinkable plastics in sheet form and guide rolls 8 and 9 serving to feed a web 10 of plastics material in sheet form from the reel 7 to the plastics material inlet region 11 of a plastics web forming guide unit 12 for forming the initially flat endless web 10 of the plastics material into an endless tube 13 of plastics sheet. The thickness of the material forming the sheet will be as though convenient for the articles to be wrapped.

The tube forming unit 12 does not form part of the invention and can be of any convenient form. Briefly, in one such known form the web forming unit 12 includes sheet material guide arrangements (not shown in detail) whereby the marginal edge regions of the web 10 entering the former unit 12 are initially turned as indicated in Figure 1 and then cused to undergo further turning so that the marginal regions are located in overlapping arrangement at the underside of the articles thereby resulting in the formation of a plastics material tube 13.

The former unit 12 is such that the articles 4 to be wrapped can be introduced into the interior thereof in such manner that the action of forming the plastics material web into the tube 13 at the same time effectively encloses the articles 4 to be wrapped. By inter-relating the rate of feed of the plastics material through the former unit 12 and the rate of feed of a succession of articles 4 through the forming unit a continuous length of the tube 13 of plastics material is produced with the articles to be wrapped located inside the tube 13 at spaced predetermined intervals lengthwise of the tube. It will be understood that control arrangements to be briefly considered hereinafter will be provided to relate the positions of the articles with respect to any printed matter provided upon

the plastics material web 10.

As will be seen when the articles leave the output end of the forming unit 2 the articles will have been partially wrapped in that the top, bottom and side walls 14,15 and 16 respectively of the articles 4 are covered with the plastics sheet 10 whilst the end regions 17 thereof are still effectively unwrapped in the sense that the length 18 of the plastics material tube 13 effectively coupling the leading and trailing end region 19 and 20 respectively of successive articles moving along the direction A, does not actually co-operate with these end regions 19 and 20.

In more general terms the partial wrapping station 2 involves covering with the tube forming plastics material those walls or surfaces of the article that extend in the direction of feed of the articles 4 through the forming unit 12 whilst those surfaces transverse to this direction are not covered with the plastics material.

As mentioned the opposite marginal edge regions of the original flat plastics web 10 are overlapped at the underside of the articles 4.

The previously mentioned conveyor arrangements are arranged to transfer the plastics tube 13 and the succession of partly wrapped articles 4A, 4B, 4C, 4D etc., entrained thereby into the plastics material heat shrinking unit 3.

This unit whih is only schematically shown includes a tunnnel 23 through which the plastics material tube 13 and its contents i.e., the articles 4A, 4B, 4C, 4D etc., can be fed.

The interior of the tunnel is subjected to a temperature/time regime which is such that the plastics material is sufficiently heated that the length 18 of the

plastics material tube 13 is located between two successive articles is caused to shrink during its passage through the tunnel and thus complete the wrapping process. It will be appreciated that of the series of articles shown in the Figure the article 4A has been fully wrapped and has been separated from the next following article 4B. The Figure also indicates the commencement of the shrinking process in relation to the next following pair of articles 4B and 4C whilst the region 18 between the article pair 4C and 4D is still unaffected by the heating processes. The heating can be achieved by any convenient means such as by a hot air flow, space heaters etc.

The temperatures involved will be related to the characteristics of the plastics sheet i.e., its chemical composition, and its thickness, and to the nature of the articles to be wrapped.

Conveniently, the temperature can be for example, 100 degrees Celcius and above. The actual temperatures used will be chosen to achieve efficient and rapid separation without damaging the plastics material to the extent that a requisite shrinkage cannot be attained. Similarly, the precise construction and dimensions of the tunnel will be set by the nature of the articles and plastics materials required to be processed. Since these factors are related to a particular application i.e., article to be wrapped no further discussion is thought necessary in this specification about these matters.

In practice, the heat generated shrinking action produces forces which pull the heated plastics material inwardly such that in due course the tubular length 18 is ruptured. The then ruptured end regions 24,25 of then ruptured tube length 18 of the plastics tube as a result of the ongoing heat shrinkage operation even after the separation of the

region 18 are pulled into close proximity with the trailing end 19 of the leading article 4A in the tunnel and the leading end 20 of the next following article 4B. In practice, it is the tightness of this shrinkage at the ends of the articles that achieves the tightness, security and quality of the wrapping.

The conveyor arrangements for feeding the tubular length 13 of plastics sheet and entrained articles through the tunnel 23 are such that not only are the separated fully wrapped articles i.e., the article 4A transferred through the tunnel but also so that the next article 4B to be fully wrapped (which becomes the leading article and which is still connected to the remainder of the tube) is pulled sufficiently into the tunnel so that this next article 4B can be similarly fully wrapped and subsequently separated from the next article 4C being fed to the heat treatment tunnel from the partial wrapping station 2.

As so far described, and as in the case of the known packaging apparatus, the precise position along the portion 18 at which the required rupturing occurs as a result of heat shrinkage is inherently uncertain. Thus, the region of rupture could be anywhere along the region 18. This situation casn result in varying amounts of plastics wrapping material being associated with a article end. In the extreme case it is possible for the end region of one of the articles being left substantially uncovered so that the ultimate wrapping of the article concerned is not adequately held in place and can thus be so loose as to separate from the article during subsequent handling. Furthermore, the uncertainty of the location of the region of rupture can affect the time period in the heating cycle at which the separation takes place and could lead to the plastics material and/or the article being wrapped being subjected to excessive heat. In the circumstances it has

been found difficult accurately to inter-relate and to maintain feed schedules for the plastics web 10 and the articles 4 to ensure correct positioning of articles lengthwise of the web 10.

In accordance with the proposals of the invention these difficulties are avoided by providing regions of physical weakness, i.e., lines easy separation or severing, in the plastics sheet web 10 prior to the entry of the plastics material into the tunnel 23. As a matter of convenience, in the apparatus being considered herein, the lines of easy separation are provided prior to the entry of the web 10 into the forming unit 12.

The Figure 1 illustrates the formation of lines 24 of easy separation by perforating the web 10 along lines transverse to the length of the web 10. These lines 24 of perforation are spaced apart lengthwise of the web 10 by a distance related to the overall length along said feed direction of an article 4.

As shown the perforations are produced by a perforating roller 26 cooperating with an associated support or anvil roller 27 which are interposed in the sheet material feed path between the rollers 8 and 9.

With the arrangements discussed there is produced series of lines 24 of perforations extending across the full width of the plastics material web and spaced at required separations.

The perforating roller 26 can be produced by mounting a serrated knife blade 27 schematically illustrated in Figure 3 on support roll to form the roller 26. Arrangements (not shown) are provided for causing the blade 26 to engage with the web 10 at pretermined positions along the length

thereof. In other words the serrated knife 27 is caused operationally to engage with the plastics web 10 each time a predetermined length of the web has been delivered from the reel. The actuation of the perforation arrangement can be effected by monitoring the actual length of material fed and/or the actuation can be related to the passage of an article to be wrapped through a predetermined location of the conveyor arrangements 5 feeding the articles 4 to the partial wrapping station 2. In either case it is important to ensure that following the formation of the web into a tube 13 of sheet plastics the lines 24 of easy separation are located midway along the length of the tube portion 18 that initially separates successive articles 4.

The depth of the knife cuts that form the perforations may be adjusted to vary, as required, the length of individual perforations and thus the magnitude of force required to sever the web across a line of perforations.

By providing the lines 24 of perforations substantially midway along the length 18 of plastics tunnel 13 between two successive articles i.e., 4B,4C the forces arising from the application of the plastics shrinking heat readily separates the plastics material at the associated line of perforations and thus at the optimum position with respect to the end regions 19,20 of articles 4 initially coupled by the tube length 18.

When it is required to wrap articles with printed plastics material or to wrap articles of differing sizes it is necessary to be able to relate the positioning of the lines 24 of easy separation with respect to the instantaneous position of the leading end of an article during its advance to the partial wrapping station 2. This control can be achieved by detecting i.e., by photoelectric cell arrangements the instantaneous position of the article

leading end and from the output of such detection producing a control signal which is used to control actuation of the perforating means i.e., roller.

Figure 2 is a part sectional; elevation schematically showing how the plastics sheet is wrapped around the top, bottom and side walls 14,15 and 16 of the articles. The Figure 2 schmatically shows the end regions of the associated wrapping 17.

Figure 4 very schematically illustrates in block diagrammatic form a control unit incorporating a microprocessor 30 for inter-relating the outputs of a number of detectors/sensors responsive to the operational conditions etc., of various parts of the apparatus shown in Figure 1. and for using such information to control operation of the various sections of the apparatus.

As may be seen from Figure 4 a sensor 31 is provided for determining the location of the leading end of the articles 4 whilst on the conveyor arrangements 5 and for feeding input to the microprocessor related to the position detected. Similarly, additional detectors/sensors can be provided where ever thought convenient. Thus sensors 32,33,34, etc., are provided for determining selected parameters associated with the operation of the apparatus of the invention. Such parameters can include the speed of feed of the wrapping material web 10 (sensor 32); the instantaneous position of any printed material on the web 10 with respect to a reference position in the feed path of the web 10 to the perforator roll 27 (sensor 33); the temperature conditions within the shrinking unit 3 (the sensor 34). The outputs from the sensors mentioned and those from any other sensors utilised are fed as data inputs to the microprocessor which is arranged so to inter-relate such input information and where necessary

compare the input data with reference data in such manner as to produce output control signals which are applied to associated control arrangements such as conveyor speed control means 35; means 36 for controlling actuation of the perforator means; means 37 for adjusting the actual perforating action of the perforator; means 38 for controlling the feed of the plastics wrapping material; and means 39 for setting and controlling the heating conditions i.e., temperature within the heat shrinkage unit 3.

It will be appreciated that further arrangements will be provided for stopping operation of the apparatus in the event of mal-functions or breakdown in the supply of wrapping material.

It will also be understood that the nature and construction of the conveyor systems provided will be related to the nature of the articles being transported. Thus if it is expected that the articles are likely to be too light in weight to be able to pull the plastics material therewith arrangements would be used to ensure that the plastics material web or film moves with the articles 4.

In a variation (not shown) provision is made for the automatic changeover between supply rolls 7 of plastics material by providing additional mandrels 6 and arrangements (not shown) for enabling 'flying splice' connection of the leading end of material from a new roll 7 to be fed to the inlet end 11 of the former unit 12 without breaking the flow of articles to the partial wrapping station.

CLAIMS

1. A method of packaging a succession of articles with heat shrinkable material, comprising the steps of feeding the articles along a predetermined feed direction to a location in which the articles are partially wrapped about surfaces thereof extending along said feed direction and in such manner that a length of the wrapping material is formed between each adjacent pair of articles, the material of said length being intended to complete the wrapping of the adjacent region of the said adjacent pair of articles, subjecting the material to a time/temperature regime such that the material forming said length is caused to shrink and in so doing produce forces sufficient to sever said length, and further to cause the servered ends to shrink and tighten against the said adjacent regions of the article pair; and pre-establishing the position at which said length severs by local physical weakening of the plastics material at predetermined locations prior to the material being subjected to the heating time/temperature regime.

2. A method as claimed in claim 1, and wherein the wrapping material is formed into a continuous tube enclosing a succession of articles to be wrapped in such manner that a length of the tube is produced between each adjacent pair of articles in said succession.

3 A method as claimed in claim 2, and wherein the local physical weakening of the wrapping material is arranged to be effected in the material prior to its being formed into the tubular form about the articles.

4. A method as claimed in claim 1,2 or 3, and wherein the local physical weakening comprises localised lines of easy separation.

5. A method as claimed in claim 4, and wherein the lines of easy separation are produced by perforating the material along predetermined lines extending transversely of the feed direction from a supply to the location at which the material is brought into wrapping relationship with the articles to be wrapped.

6. A method as claimed in any of claims 1 to 5, and wherein when it is required to wrap articles with printed wrapping material and/or articles of differing sizes the positioning of the lines of easy separation are related to the instantaneous position of the leading end of an article in its advance to co-operation with the wrappng material.

7. Apparatus for packaging a succession of articles with heat shrinkable material, comprising means for feeding the articles along a predetermined feed direction to a location in which the articles are partially wrapped about surfaces thereof extending along said feed direction and in such manner that a length of the wrapping material is formed between each adjacent pair of articles, the material of said length being intended to complete the wrapping of the adjacent region of the said adjacent pair of articles, means for subjecting the material to a time temperature/regime such that the material forming said length is caused to shrink and in so doing produce forces sufficient to sever said length and further to cause the servered ends to shrink and tighten against the said adjacent regions of the article pair; and means for

pre-establishing the position at which said length severs by local physical weakening of the plastics material at predetermined locations prior to the material being subjected to the heating time/temperature regime.

8. Apparatus as claimed in claim 7, and including means for forming a continuous length of wrapping material into a continuous tube about a succession of articles to be wrapped in such manner that a length of the tube is produced between each adjacent pair of articles in said succession.

9. Apparatus as claimed in claim 8, and wherein the means for producing the local physical weakening is arranged to effect such weakening prior to its being formed into a tubular form about the article.

10. Apparatus as claimed in claim 7,8 or 9, and wherein the means for effecting said local physical weakening comprises means for producing localised lines of easy separation in the wrapping material.

11. Apparatus as claimed in claim 10, and wherein the means for producing the lines of easy separation includes means for perforating the wrapping material along predetermined lines extending transversely of the feed direction thereof from a supply to the location at which the material is brought into wrapping relationship with the articles to be wrapped.

12. Apparatus as claimed in any one of claims 7 to 11, and wherein when it is required to wrap articles with printed plastics material or to wrap articles of differing sizes means are provided for relating the positioning of the lines of easy separation with respect to the instantaneous position of the leading end of an article during its advance to the location at which it is contacted by the wrapping material.

13. Apparatus for packaging a succession of articles with heat shrinkble wrapping material constructed and arranged to operate substantially as hereinbefore described with reference to the accomapnying drawings.